REMARKS/ARGUMENTS

This Amendment is in response to the Office Action mailed 10/17/2003. In the Office Action, the Examiner objected to the drawings and the specification and rejected (i) claims 7-14 and 31-35 under 35 U.S.C. § 112, (ii) claims 7, 8 and 10-14 and 31-35 under 35 U.S.C. § 102, and (iii) claims 7, 8, 10-14 and 31-35 under 35 U.S.C. § 103. Reconsideration in light of the amendments and remarks made herein is respectfully requested.

In the specification, the paragraph that begins on page 9, line 1, has been amended to correct minor informalities.

Claims 7-14 and 31-35 remain in this application.

The Examiner states that the reply dated 7-21-03 is not fully responsive to the prior Office Action because the rejection of claim 13 has not been addressed. In response, Applicants have amended claim 13 to correct the antecedent basis.

Objection to Drawings

The Examiner states that the drawings do not show every feature of the invention specified in the claims. Applicants respectfully disagree. The drawings show all the necessary features in the claims. For example, Figure 3 shows the first underfill material 24 as recited in claims 7, 11 and 31 ("dispensing the first material acting as underfill"), the second underfill material 26 as recited in claims 7, 11 ("dispensing a second material to form a circumferential fillet"), and 31 ("dispensing a second material only around a periphery … to form a circumferential fillet"). Figure 4 shows (1) the substrate 12 initially baked as recited in claims 11 and 31 ("heating the substrate"), (2) dispensing the first underfill material 24 as recited in claims 1, 11 and 31 above; and (3) dispensing the second underfill material 26 as recited in claims 1, 11 and 31 above.

Accordingly, Applicants respectfully request that the Examiner withdraw the objection to the drawings.

Specification

The Examiner objects to the specification. In the Office Action, the Examiner stated that trademarks for Semicoat 5230-JP and Semicoat 112X should be capitalized. In response, Applicants have amended the Specification to capitalize Semicoat 5230-JP and Semicoat 112X.

The Examiner further objected to the Specification as being insufficient because proper identification of the product sold under trademarks Semicoat 5230-JP and Semicoat 112X is omitted from the Specification and such identification is deemed necessary. Applicants respectfully disagree. First, the product identification of Semicoat 5230-JP and Semicoat 112X

is complete as described in the Specification (see Specification, page 8, lines 19-25; page 9, lines 1-2). Second, the use of these products are merely for illustrative purposes, and not necessary for the principles of the invention.

The Examiner further requested information on the product identified by the trademarks Semicoat 5230-JP and Semicoat 112X under 37 CFR 1.105. As discussed above, these products are specified for illustrative purposes only. Similar products having similar characteristics, i.e., the second underfill material having lower adhesion properties and better fracture/crack resistance than the first underfill material, may be used. However, in compliance with the request, Applicant is attaching the product information in the Appendix A.

Accordingly, Applicants respectfully request that the Examiner withdraw the objection to the specification.

Rejection Under 35 U.S.C. § 112

a) The Examiner rejects claims 7-14 and 31-35 under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. Specifically, the Examiner states that the undescribed subject matter of the claimed invention is the limitations "the second material having a lower adhesive property than the first material" (claim 1), and "...having a lower adhesion property than the first material..." (claims 11 and 32). Applicants respectfully disagree.

Adhesive property is a common property of material used in encapsulating semiconductor devices. Applicants are attaching in Appendix B a product description of the material. Accordingly, Applicants respectfully request that the Examiner withdraw the rejection of claims 7-14 and 31-35 under 35 U.S.C. § 112, first paragraph.

b) <u>Negative Limitation:</u>

The Examiner states that claim 31 contains a negative limitation not supported in the specification. In response, Applicants have amended claim 31 to remove the negative limitation.

c) <u>Genus Limitation:</u>

The Examiner further states that the specification does not reasonably provide enablement for the genus limitation of claim 7. Specifically, the Examiner refer to the "adhesive property" in the claims. As discussed above, the adhesive property is a common property of material used in encapsulating semiconductor devices.

d) The Examiner rejects claims 7-14 and 31-35 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The Examiner states that claims 7-10 are incomplete because claims 7 omits an essential structural cooperation relationship of element. The Examiner further states that the limitation "dispensing a second material acting as a circumferential fillet" does not define a cooperative structural relationship between the second material and the remaining claimed structure. In response, Applicants have amended claim 7. Accordingly, Applicants respectfully request that the Examiner withdraw the rejection of claims 7-14 and 31-35 under 35 U.S.C. § 112, second paragraph.

e) The Examiner further states that no art recognizes definition and quantification of adhesive and adhesion. Applicants respectfully disagree and direct the Examiner's attention to the argument above.

f) The Examiner states that the scope of the limitations "as a circumferential fillet" and "an underfill" is indeterminable. In response, Applicant has amended claims 7, 11 and 31 to clarify the claim language.

Accordingly, Applicant respectfully requests that the Examiner withdraw the rejection of claims 7-14 and 31-35 under 35 U.S.C. § 112, first and second paragraph.

Rejection Under 35 U.S.C. § 102

The Examiner rejects claims 7, 8 and 10 under 35 U.S.C. § 102(e) as being anticipated by Asai (U.S. Patent 6,376,906) ("Asai"). Applicant respectfully traverses the rejection and contends that the Examiner has not met the burden of establishing a *prima facie* case of anticipation. Namely, to anticipate a claim, the reference must teach every element of the claim. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Vergegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ 2d 1051, 1053 (Fed. Cir. 1987).

Asai discloses a mounting structure of semiconductor element. A reinforcement resin is injected into a space between a flip chip integrated circuit and a substrate (Asai, col. 1, lines 33-36). During thermal testing, separation of the reinforcement resin from the substrate starts from a joining portion between an edge portion A of the reinforcement resin around the flip chip and the wiring members (Asai, col. 1, lines 41-46).

The Examiner states that Asai discloses dispensing a first material 9 acting as underfill and dispensing a second material 9 acting as a circumferential fillet. Applicants respectfully disagree. Asai merely discloses dispensing one material, namely reinforcement resin 9, in a space between the flip chip IC and the substrate (Asai, col. 1, lines 33-36). In contrast, in the claimed invention, the second material is different than the first material, as amended in claims 7, 11 and 31.

The Examiner further rejected claims 7, 8, 10-14, and 31-35 under 35 U.S.C. § 102(b) as being anticipated by Ameen (0340492) ("Ameen"). Applicant respectfully traverses the rejection and contends that the Examiner has not met the burden of establishing a *prima facie* case of anticipation.

Ameen discloses conformal sealing and interplanar encapsulation of electronic device structures. In Ameen, the overcoat material and the undercoat material are of the same type. They are both formed from a solventless liquid polymer (Ameen, col. 3, lines 10-13; lines 25-28). In the present invention, the second underfill material is different than the first underfill material. As stated on page 6 of the Specification, the second underfill material has lower adhesion properties but much better fracture/crack resistance than those of the first underfill material.

Accordingly, Applicants respectfully request that the Examiner withdraw the rejection of claims 7, 8 and 10 under 35 U.S.C. § 102(e) and claims 7, 8, 10-14 and 31-35 under 35 U.S.C. § 102(b).

Rejection Under 35 U.S.C. § 103

The Examiner rejects claim 9 under 35 U.S.C. § 103(a) as being unpatentable over Ameen as applied to claim 8, and further in combination with Bouras (U.S. Patent 5,906,682) ("Bouras"). Applicants respectfully traverse the rejection and contend that the Examiner has not met the burden of establishing a *prima facie* case of obviousness.

Bouras discloses a flip chip underfill system and method. Printed Circuit (PC) boards are heated by conduction in belt ovens having successive air zones (Bouras, col. 2, lines 55-58). A radiant heat source is energized by a PC board heater controller circuit (Bouras, col. 5, lines 33-34).

Ameen and Bouras, taken alone or in combination, does not disclose, suggest or render obvious (1) dispensing a first material to form an underfill which becomes attached to the integrated circuit and the substrate, (2) dispensing a second material to form a circumferential fillet, the second material being different than the first material and having a lower adhesive property than the first material, and (3) wherein the substrate moves within an oven while the first material flows between the integrated circuit and the substrate.

Bouras merely disclose heating a PC board, not an integrated circuit and a substrate. The heating is performed when all the devices have already been populated on the PC board, not when the first material flows between the integrated circuit and the substrate. Furthermore, the interior chamber in Bouras is used to communicate with the needle and upon which a vacuum is pulled by a vacuum source (Bouras, col. 5, lines 52-54). It is not an oven within which the substrate moves.

The Examiner further rejected claims 7, 8, 10-14, and 31-35 under 35 U.S.C. 103(a) as being unpatentable over Ameen and in combination with Applicant's admitted prior art (AAPA). Applicants respectfully disagree and contend that the Examiner has not met the burden of establishing a *prima facie* case of obviousness.

Ameen and AAPA, taken alone or in combination, does not disclose, suggest, or render obvious (1) dispensing a first material to form an underfill which becomes attached to the integrated circuit and the substrate, and (2) dispensing a second material to form a circumferential fillet, the second material being different than the first material and having a lower adhesive property than the first material.

Ameen does not disclose any of the above elements as discussed above. AAPA merely discloses two types of materials, SEMICOAT 5230JP and SEMICOAT 122X. AAPA does not disclose, suggest or render obvious using these two materials as an underfill and a circumferential fillet.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. MPEP §2143, p. 2100-124 (8th Ed., rev. 1, Feb. 2003). Applicants respectfully contend that there is no suggestion or motivation to combine their teachings and that no *prima facie* case of obviousness has been established

Accordingly, Applicants respectfully requests that the Examiner withdraw the rejection of claims 7, 8, 9-14, and 31-35 under 35 U.S.C. § 103(a).

Conclusion

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Dated: January 7, 2004 By _____

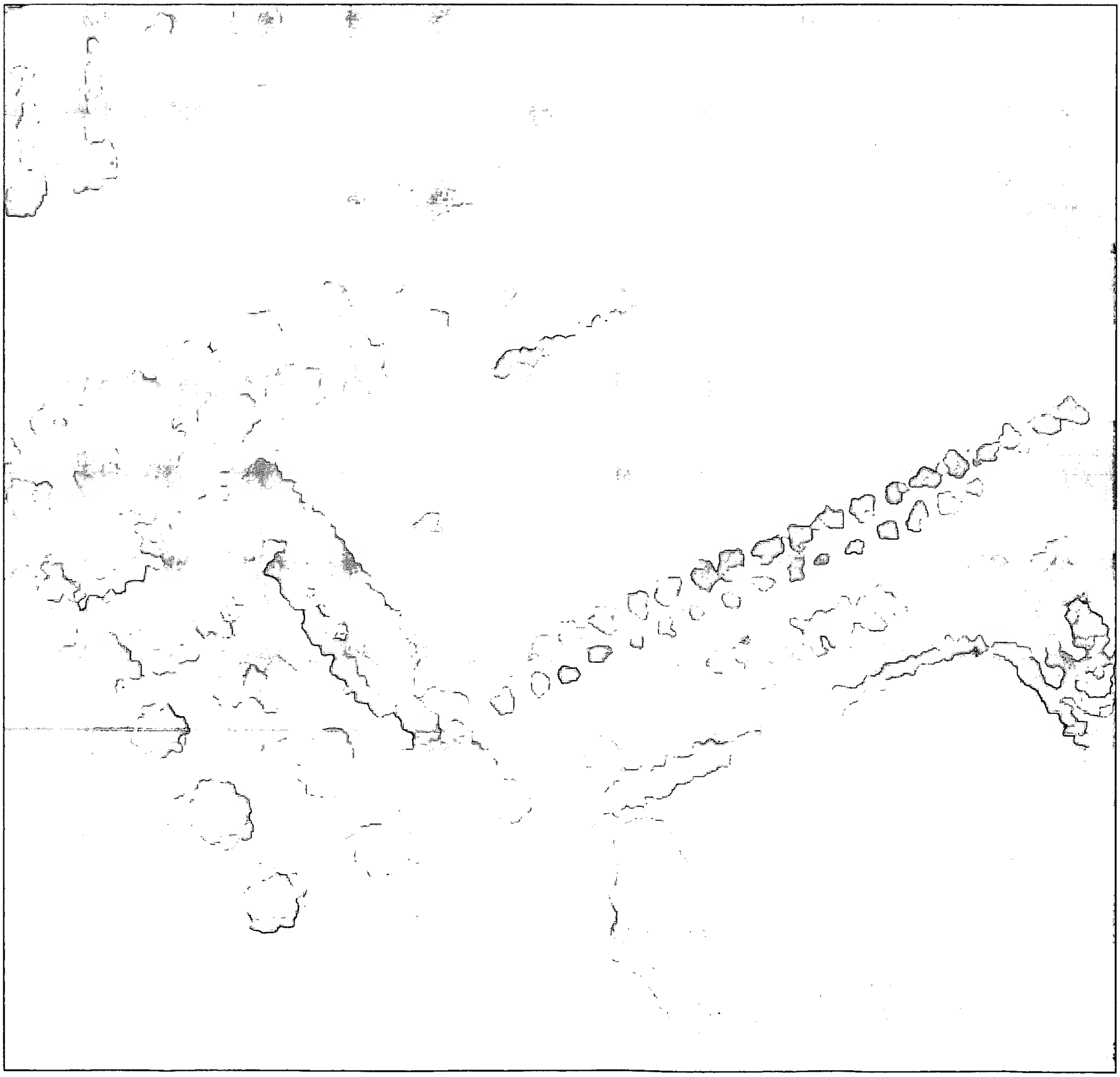
Thinh V. Nguyen
Reg. No. 42,034
Tel.: (714) 557-3800 (Pacific Coast)

12400 Wilshire Boulevard, Seventh Floor
Los Angeles, California 90025

Shin-Etsu

Shin-Etsu Liquid Coating Materials for Electronic Devices

KJR Series & SEMICOAT Series

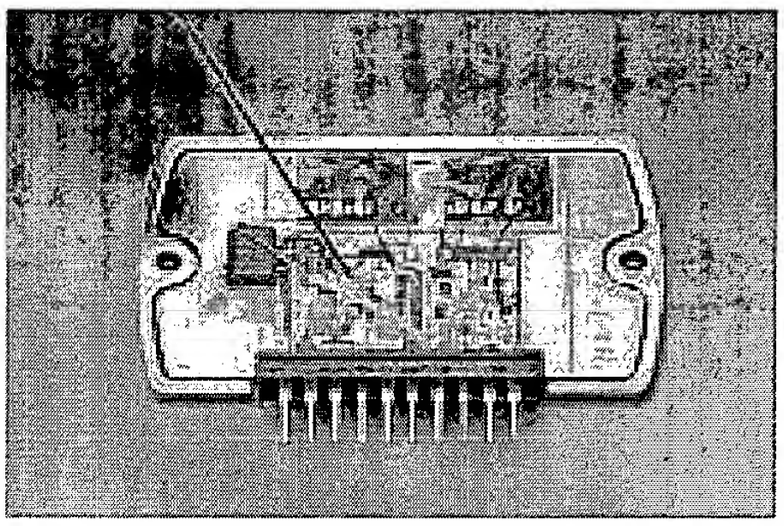


KJR Series

Junction Coating Resins
Liquid Type Silicone & Polyimide Silicone for Electronic, Electric and Optical Devices

Main Features

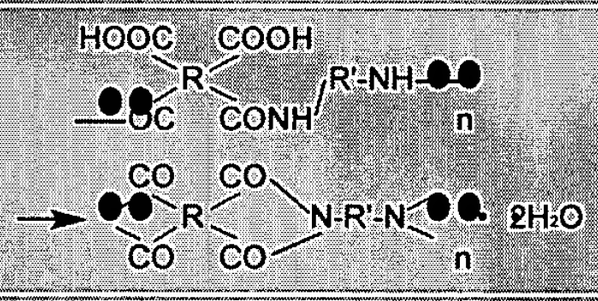
- Ultra High Purity
- High Thermal Stability
- High Electrical Stability
- High Mechanical Stability
- Excellent Adhesive Strength



Classification of KJR Series

The KJR Series can be classified into three categories according to the chemical curing mechanism used. The manufacturing process or some characteristic of the devices to be coated may dictate which group you select for particular application.

Chemical Curing Mechanisms

Type	Curing Condition	Chemical Mechanism	By-Product	Grade
Rigid	Heat • Condensation		H_2O	KJR650E Series • Polyimide Silicone
Flexible	Moisture • Condensation	$\equiv SiOR + H_2O \rightarrow \equiv SiOH + ROH$ $\equiv SiOR + HOSi\equiv \rightarrow \equiv SiOSi\equiv + ROH$	ROH	KJR4000E Series • Silicone
Flexible • • Gel	Heat • Addition	$\equiv SiCH + CH_2 + HSi\equiv \rightarrow \equiv SiCH_2CH_2Si\equiv$	None	KJR9000E Series • Silicone

Rigid Type

After curing, this coating film hardens to a highly rigid polyimide.
Since it is also has excellent adhesive properties, it is ideal for coating of particularly high voltage resistant devices.

Flexible Type

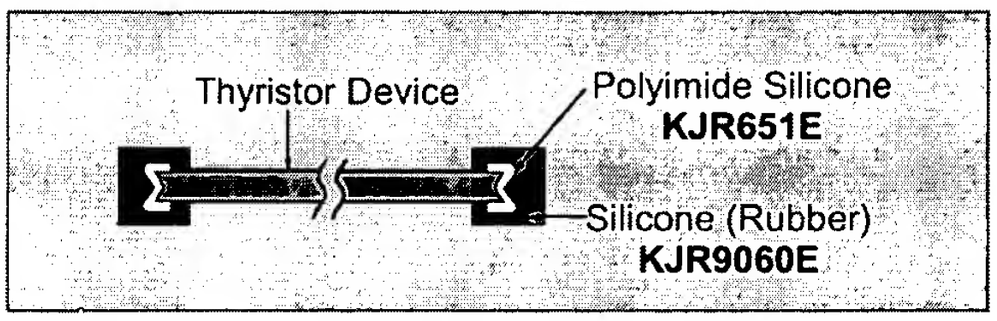
After curing, this coating film has outstanding rubber elastic properties.
By absorbing stress due to external forces, it can prevent fracturing of devices or breakage of bonding wires.

Gel Type

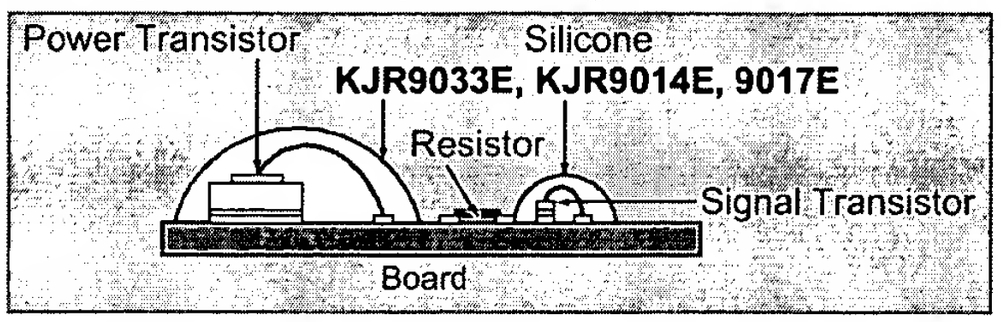
After curing, this coating film is a soft gel type of material.
It has extremely low stress compared with the rubber type, so maximum buffer effect can be achieved.
Since it has superb adhesion strength and lead sealing, it can provide the best humidity protection.

Typical Application of KJR Series for Various Devices

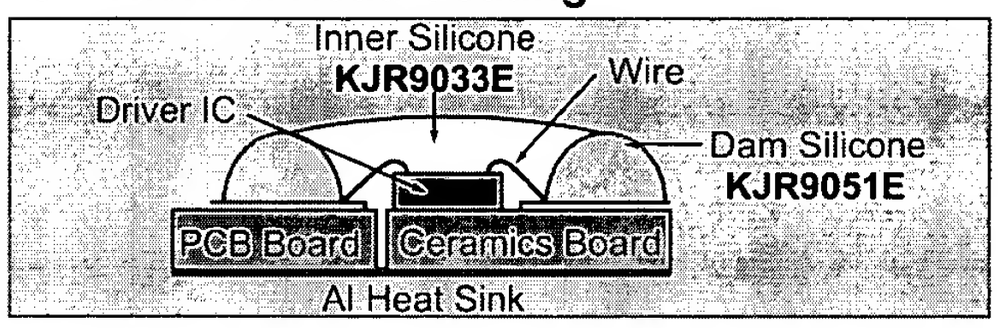
- a• GTO Thyristor Coating



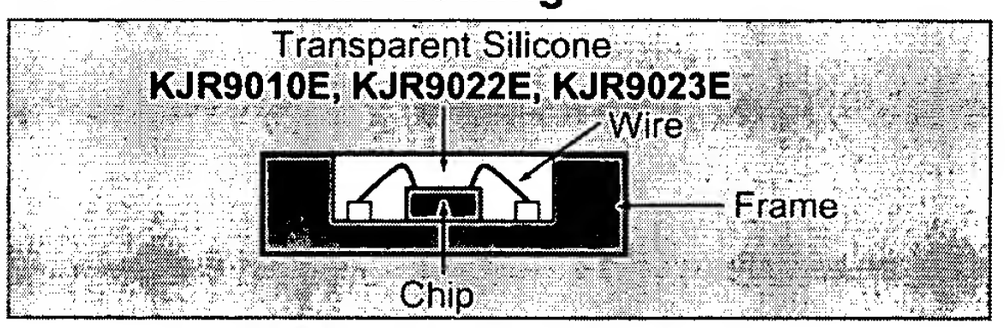
- b• Hybrid IC Chip Coating



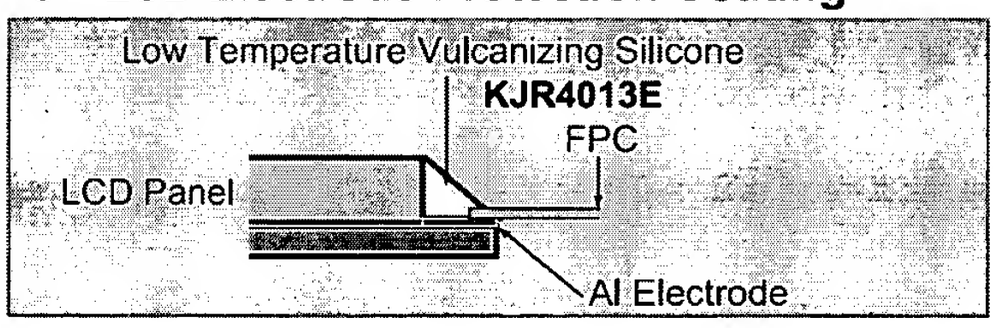
- c• Thermal Head Coating



- d• Photo Diode Coating



- e• LCD Electrode Protection Coating



Curing KJR Series Resins

The KJR Series resins maintain primarily two types of curing schedules• heat curable, and moisture curable. The heat curable type material requires a heat cure of 150• •to 170• •for one to four hours. Our moisture cure material requires more than 40 percent relative humidity for 24 hours at room temperature.

In most cases, post-curing is also required to obtain optimum properties with the greatest resistance to temperature extremes and improved reliability of coated devices.

Several of the KJR-9010E Series will remain in a gel state and do not require post-curing.

Type	Product Name	Cure Condition	Post Cure Condition
Flexible	9051E 9052E	80• 100• /1• 4Hr	200• /4• 16Hr
	9022E 9023E 9050E	100• 150• /1• 4Hr	200• /4• 16Hr
	9033E 9060E 9061E	150• 170• /1• 4Hr	200• /4• 16Hr
	4010E 4013E 4012E 4050E	20• 25• /45• 65• •RHD/24Hr • 150• /1• 4Hr	200• /4• 16Hr
Gel	9010E 9015E	100• 150• /1• 4Hr	200• /4• 16Hr
	9014E 9017E	150• 170• /1• 4Hr	200• /4• 16Hr
Rigid	651E 654E	150• /1Hr• 200• /1Hr• 250• /4Hr	300• /0.5• 4Hr
	653E	150• /1Hr• 200• /16Hr	250• /0.5• 4Hr

KJR Series

Reduced Impurities, Higher Stability for Superior Semiconductors

Impurity

Very Low Ionic Impurity Reduces Risk of Corrosion

KJR Series resins are extremely pure, offering superior stability to all types of semiconductor devices. The most critical impurity, chloride ion, is kept to an absolute minimum, greatly reducing the risk of electrode corrosion.

Ionic Impurities

• ppm •

Grade \ Ion	Na• •	K• •	Cl• •
KJR Series	0.1	0.2	1.0
General Silicone	0.5	5	5• 10

Low Uranium Content for Alpha Particle Sensitive D vices

The low uranium content of KJR Series resins is an important feature in improving the performance of devices.

Content of Uranium

• ppb• •

Product	Uranium Content
KJR Series	Undetective
KJR651E	Undetective
Synthetic Quartz	• 1.0
Natural Quartz	• 30

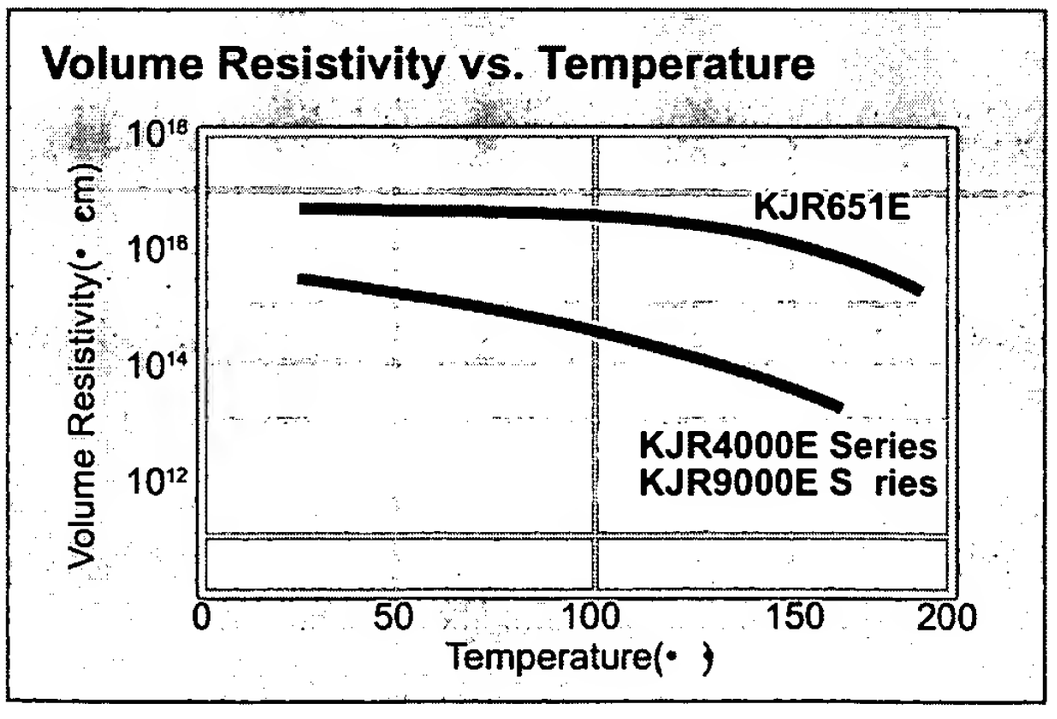
fluorometric Method

Electrical Stability

Electrical Stability over a Broad Temperature Range

At high and low temperature extremes, KJR Series resins maintain electrical stability, due to the combination of basic organo-siloxane bonding and the low content of ionic impurities. The result is a more reliable device that operates safely in a wide variety of conditions, even at very high temperatures.

The KJR651E, a copolymer structure composed of polyimide and polysiloxane, possesses superior high temperature properties.

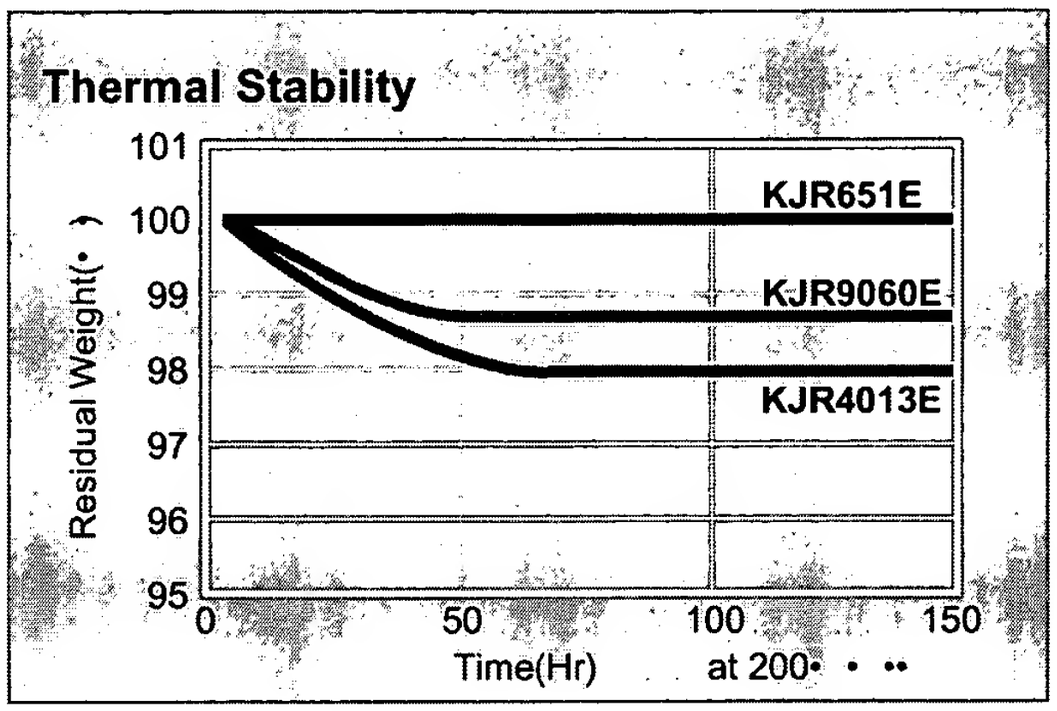


Thermal Stability

Thermal Stability Protects Against Extremes

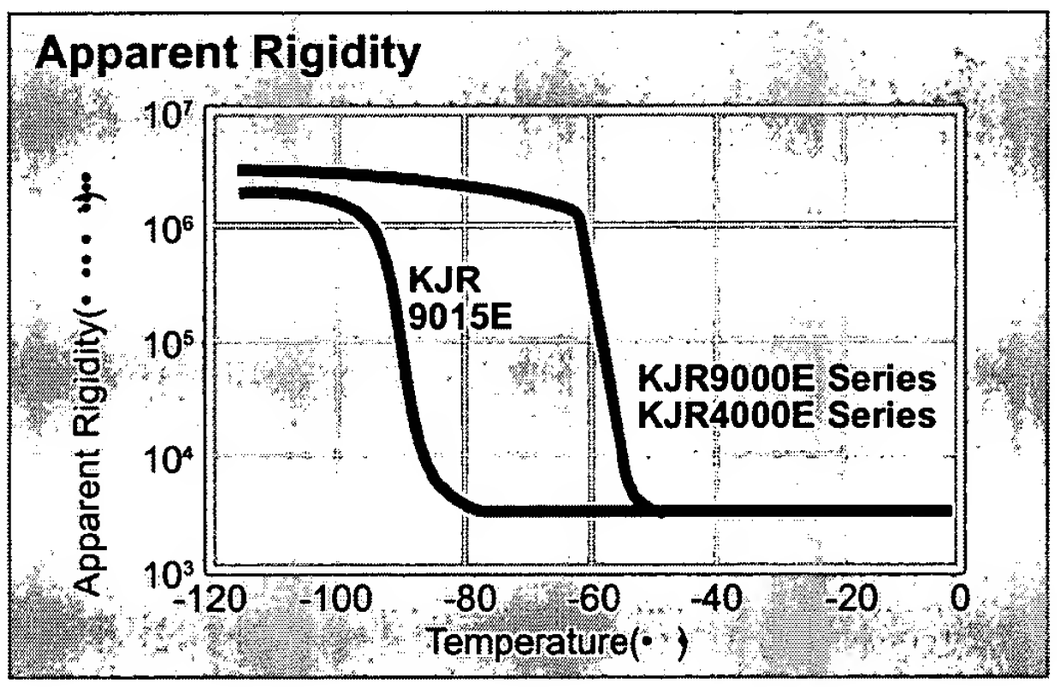
Thermal stability derived from the inherent properties of silicones gives the KJR Series the ability to protect devices from the extremes of heat shock, solder dip and other situations.

The KJR651E with its special copolymer structure is the most stable, capable of withstanding temperatures as high as 250• :



Flexibility Down to • 80• •

KJR9015E maintains its flexibility at temperatures as low as • 80• ; providing an effective buffer against severe thermal shock.



Adhesive Property

Improved Breakdown Voltages with Higher Adhesive Strength

The KJR Series shows a very good affinity for the metallic and ceramic substrates used in semiconductor manufacturing. Higher breakdown voltages and lower leak currents result from the bonding properties of the KJR Series.

Post-curing is recommended to further improve the adhesive strength and stability of KJR Series resins.

• 1 Shear Strength kg/cm²• •
• 2 Area of JCR remaining on substrate after Shear Test percent• . •

Adhesive Strength

		Silicon Substrate		Aluminum Substrate	
	GRADE	Strength *1	Residual Area *2	Strength *1	Residual Area *2
Flexible Type	4010E	3	100	3	100
	4012E	3	100	3	100
	4013E	8	100	8	100
	4050E	4	100	4	90
	9010E	• •	100	• •	100
	9014E	• •	100	• •	100
	9015E	• •	100	• •	100
	9022E	8	100	8	100
	9023E	2	100	2	100
	9033E	3	100	3	100
	9050E	4	100	6	100
	9051E	6	100	6	100
	9052E	3	100	3	100
	9060E	10	100	10	100
	9061E	10	100	10	100

KJR Series

General Properties

Type		Rigid Type							
Item / Product Name / Unit		KJR651E	KJR653E	KJR654E	KJR4010E	KJR4012E	KJR4013E	KJR4050E	KJR9022E
Component		One	One	One	One	One	One	One	Two
Polymerization		Thermoset	Thermoset	Thermoset	Moisture cure	Moisture cure	Moisture cure	Moisture cure	Thermoset
Appearance		Brown	Brown	Brown	White	Translucent	White	Translucent	Transparent
Non volatile part		25	24	19	100	100	100	100	100
Solvent		N-Methyl-2-pyrrolidone	N-Methyl-2-pyrrolidone	Xylene-N-Methyl-2-pyrrolidone	None	None	None	None	None
Viscosity	Poise	20	2.3	4	30	30	55	350	40
Shelf Life	Month	3	3	3	6	6	6	6	6
Mixing Ration	Base/cure agent								100/10
Pot Life	Hr								10
Tack Free Time	Hr						2	1	
Cure Condition	/Hr	150/1 200/1	150/1 200/16	150/1 200/1	25/24 150/4	25/21 150/4	25/24 150/4	25/24 150/4	150/4
Specific gravity					1.05	1.05	1.26	1.05	1.01
Hardness	Shore	80 D	80 D	80 D	22 A	20 A	38 A	18 A	42 A
Tensile Strength	kg/cm²	1,400	800	1,400	15	12	20	17	50
Elongation		80			200	200	150	300	150
Adhesive Strength	Silicon	kg/cm²			3 100	3 100	8 100	4 100	8 100
	Aluminum	kg/cm²			3 90	3 90	8 100	4 90	8 100
Volume Resistivity	cm	1 10¹⁶	1 10¹⁶	1 10¹⁶	1 10¹⁵	1 10¹⁵	1 10¹⁵	1 10¹⁵	5 10¹⁵
Dielectric Strength	kV mm	18 0.1mm	18 0.1mm	18 0.1mm	24	22	25	23	25
Dielectric Constant	50Hz	3.1	3.1	3.1	3.0	3.0	3.3	3.0	2.9
Dissipation Factor	50Hz	3.1 10⁻³	3.2 10⁻³	3.1 10⁻³	5 10⁻⁴	5 10⁻⁴	3 10⁻⁴	5 10⁻⁴	5 10⁻⁴
Applicable Temperature		50 300	50 300	50 300	50 200	50 200	50 200	50 200	50 200

Application									
Diode									
Rectifier									
Thyristor									
Transistor									
Opto Coupler									
L.E.D.									
LCD									
Integrated Circuit									
Hybrid IC									

More than 60 Relative Humidity Penetration Measure

Flexible Type								Gel Type			
KJR9023E	KJR9025E	KJR9033E	KJR9060E	KJR9061E	KJR9050E	KJR9051E	KJR9052E	KJR9010E	KJR9014E	KJR9015E	KJR9017E
Two	Two	One	One	One	Two	Two	Two	Two	One	Two	One
Thermoset	Thermoset	Thermoset	Thermoset	Thermoset	Thermoset	Thermoset	Thermoset	Thermoset	Thermoset	Thermoset	Thermoset
Transparent	Translucent	White	Translucent	Translucent	Black	Gray	Translucent	Transparent	Translucent	Transparent	Transparent
100	100	100	100	100	100	100	100	100	100	100	100
None	None	None	None	None	None	None	None	None	None	None	None
40	70	50	90	170	300	50	90	7	100	8	8
6	6	3	3	3	6	6	6	6	3	6	3
100/10	100/100	•	•	•	100/10	100/10	100/10	100/10	• •	100/100	• •
24	24	•	•	•	24•	24	24	8	• •	8	• •
•	•	•	•	•	•	•	•	•	•	•	•
150/4	80/2	150/4	150/4	150/4	150/4	80/2	80/2	150/2	150/2	150/2	150/2
0.99	1.00	1.0	1.0	1.0	1.04	1.18	1.00	0.97	1.00	0.99	0.99
22 A• •	17 A• •	20 A• •	10 A• •	18 A• •	35 A• •	44 A• •	16 A• •	65 ···	65 ···	65 ···	65 ···
7	5	5	16	• •	15	15	7	•	•	•	•
150	200	150	600	600	180	150	180	•	•	•	•
2 400•	•	3 400• •	10 400• •	10 400• •	4 70•	•	•	•	•	•	•
2 400•	•	3 400• •	10 400• •	10 400• •	6 400•	•	•	•	•	•	•
1• 40^{15}	5• 40^{14}	1• 40^{15}	2• 40^{15}	2• 40^{15}	1• 40^{15}	1• 40^{15}	1• 40^{15}	1• 40^{15}	1• 40^{15}	1• 40^{15}	1• 40^{15}
23	21	21	24	23	25	28	22	•	•	•	•
2.8	2.9	2.9	2.8	2.8	3.0	3.0	2.7	3.0	3.0	3.0	3.0
5• 40^{-4}	5• 40^{-4}	4• 40^{-4}	4• 40^{-4}	5• 40^{-4}	5• 40^{-4}	3• 40^{-8}	2• 40^{-4}	4• 40^{-4}	4• 40^{-4}	4• 40^{-4}	4• 40^{-4}
• 50• 200	• 50• 200	• 50• 200	• 50• 250	• 50• 250	• 50• 200	• 50• 200	• 50• 200	• 50• 200	• 50• 200	• 80• 250	• 80• 250
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			• •					• •	• •	• •	• •
	• •	• •	• •		• •	• •	• •	• •	• •	• •	• •

KJR Series

Inhibitors Against KJR9000E Series

Curability of grade nos. with 9000E Series will decline if catalysts lose their activity by some compounds.
Before using 9000E Series, curing equipment and containers must be washed well and take care of contamination of inhibitors as follows;

Inhibitors

The compounds which will be the inhibitors have atoms of N, P, S, or Sn in their molecules.

N :Amines, Isocyanates, Amides, Nitriles, etc.
P :Phosphines, Phosphoxides, Phosphoric Esters, etc.
S :Mercaptans, Sulfonates, Sulfides, etc.
Sn :Organo-Tin Compounds Chlorides, Esters, etc.• , etc.

Strength of Inhibitors

The order strength of inhibitors as above is P• •S• •Sn, N. Curability of 9000E Series decline if phosphor compounds are contaminated in several ppm.

Moisture

Moisture, other than the above mentioned inhibitors, has influence upon curability of 9000E Series.
So, please use them paying attention to invasion of moisture.

Handling KJR Series Resins

Storage

To prolong shelf-life, store KJR Series resins in a cool, dark place such as a refrigerator• . •The seal of the bottle should be examined and kept tight to reduce the possibility of moisture or contaminants contacting the resins• • particularly with moisture-cure grade resins.

Preparation

Stir KJR Series resins before using to prevent separation. All grades should be deaerated to minimize the risk of air bubbles in the coating. This is especially critical with the two-component variety. Deaeration should be carried out at a vacuum of less than 15mm Hg for approximately 20 minutes.
The resins should be mixed at the prescribed mix ratio, as shown in the selector guid See General Properties• . •

Coating and Curing

During the coating process, dispense the resins mechanically with specially designed dispensing equipment, or manually by syringe. Protect the coatings from contamination due to moisture, ionic materials, and other foreign substances.
Ensure proper ventilation to remove condensation products from the curing oven.

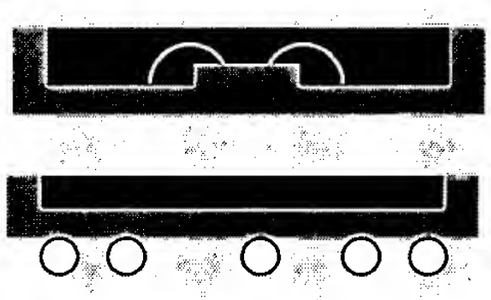
Post Cure

Perform post-cure at approximately 200• •for four to sixteen hours. The post-cure process is essential in improving the resins' passivation quality for all grades with the exception of gel type KJR Series.

SEMICOAT Series

Liquid Epoxy Coating Agents for Semiconductors
One Component Thermosetting Type

Typical Application of SEMICOAT Series for Semiconductors

Application		Product Name
Potting for PGA, BGA etc.		SEMICOAT 114, SEMICOAT 115, X-43-5012A, SEMICOAT 122, SEMICOAT 124*
Underfill for Flip Chip		X-43-5107, X-43-5107-1, X-43-5107-2, X-43-5123, X-43-5127
Glob Top for COB		SEMICOAT 220L, 220H, 227, SEMICOAT 120X-1, SEMICOAT 125H*
Dam Forming • Bank Agent• •		X-43-5255

• UL94V-0 recognized component

SEMICOAT Series

Potting for PGA, BGA etc.

Product Name		SEMICOAT 114	SEMICOAT 115	X-43-5012A	SEMICOAT 122	SEMICOAT 124
Feature		Low viscosity	Low viscosity Low stress	Low stress Good Adhesion	Low stress Small warpage	Low stress Flame resistance
Aspect Ratio		0.10	0.05	0.05	0.05	0.05
ITEM	UNIT					
Appearance		Black	Black	Black	Black	Black
Viscosity 25	poise	55	400	1000	400	900
Gelation Time 150	sec	60	70	70	60	70
Flexural Strength 25	kgf/mm²	8	10	10	11	10
Flexural Modulus 25	kgf/mm²	450	1100	1300	1300	1000
Coefficient of Thermal Expansion 1	ppm/	45	20	15	15	20
Coefficient of Thermal Expansion 2	ppm/	140	80	60	60	80
Glass Transition Temp.		135	145	145	155	145
Volume Resistivity at 25	cm	2 10¹⁶	2 10¹⁶	2 10¹⁶	2 10¹⁶	1 10¹⁶
Dielectric Constant at 1kHz		4.0	3.5	3.3	3.6	3.5
Recommended Cure Condition		100 /1Hr 150 /1Hr	100 /0.5Hr 150 /2Hr	100 /0.5Hr 150 /2Hr	100 /1Hr 150 /2Hr	100 /0.5Hr 150 /2Hr
Dispense Condition Device Temp.		22 50	70 90	70 90	70 90	70 90
Storage Condition		Below 5	Below 5	Below 5	Below 40	Below 5

to avoid trapping air in dispense process.

1 UL94V-0 recognized component

Underfill for Flip Chip

Product Name		Special formulation			Standard type	
		X-43-5107	X-43-5107-1	X-43-5107-2	X-43-5123	X-43-5127
Feature		High reliability Good penetration	High reliability Better penetration	Low viscosity More better penetration	Low viscosity Good penetration	Low viscosity Better penetration
Possible Gap Size	m	20 100	20 100	20 100	40 100	20 100
ITEM	UNIT					
Appearance		Black	Black	Black	Black	Black
Viscosity 25	poise	2500	1000	360	150	80
Viscosity 100	poise	7.8	3.5	1.8	2.0	1.5
Gelation Time 150	sec	330	330	330	75	75
Flexural Strength 25	kgf/mm²	10	10	10	10	10
Flexural Modulus 25	kgf/mm²	800	700	600	650	650
Coefficient of Thermal Expansion 1	ppm/	27	32	38	32	32
Coefficient of Thermal Expansion 2	ppm/	80	91	98	105	105
Glass Transition Temp.		140	140	140	145	145
Volume Resistivity at 25	cm	1 10¹⁶	1 10¹⁶	1 10¹⁵	1 10¹⁶	1 10¹⁶
Dielectric Constant at 1kHz		3.8	3.8	3.8	3.5	3.5
Recommended Cure Condition		120 0.5 Hr + 150 2Hr			100 0.5 Hr + 150 2Hr	
Dispense Condition Device Temp.		110 130			80 100	
Storage Condition		Below 5			Below 5	

1 UL94V-0 recognized component

Glob Top for COB(thixotropic type)

Product Name		SEMICOAT 220L	SEMICOAT 220H	SEMICOAT 227	SEMICOAT 120X-1	SEMICOAT 125H
Feature		Low thixotropy	Middle thixotropy	High thixotropy	Low stress Middle thixotropy	Hame resistance Middle thixotropy
Aspect Ratio		0.14	0.20	0.28	0.18	0.24
ITEM	UNIT					
Appearance		Black	Black	Black	Black	Black
Viscosity 25	poise	850	900	1000	1100	900
Gelation Time 150	sec	70	70	70	65	70
Flexural Strength 25	kgf/mm²	10	10	10	10	8
Flexural Modulus 25	kgf/mm²	800	800	800	1200	850
Coefficient of Thermal Expansion 1	ppm/	24	24	24	15	24
Coefficient of Thermal Expansion 2	ppm/	95	95	95	60	95
Glass Transition Temp.		140	140	140	150	145
Volume Resistivity at 25	cm	2 10¹⁶	2 10¹⁶	2 10¹⁶	2 10¹⁶	1 10¹⁶
Dielectric Constant at 1kHz		3.5	3.5	3.5	3.6	3.5
Recommended Cure Condition		100 /0.5Hr 150 /2Hr	100 /0.5Hr 150 /2Hr	100 /0.5Hr 150 /2Hr	100 /1Hr 150 /2Hr	100 /0.5Hr 150 /2Hr
Dispense Condition Device Temp.		60 80	60 80	60 80	60 80	60 80
Storage Condition		Below 5	Below 5	Below 5	Below 40	Below 5

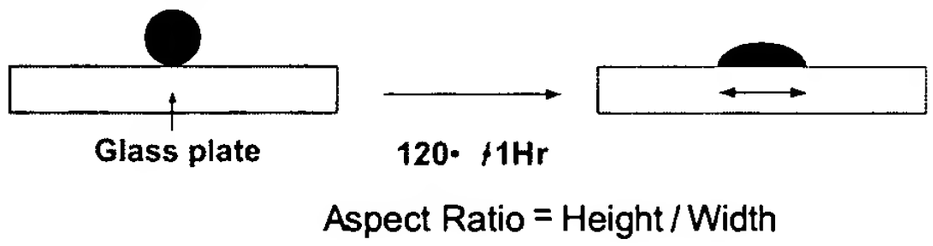
1 UL94V-0 recognized component

Dam Forming

Product Name		X-43-5255
Feature		High thixotropy Good shape retention
Aspect Ratio		0.75
ITEM	UNIT	
Appearance		Black
Viscosity 25	poise	7000
Gelation Time 150	sec	70
Flexural Strength 25	kgf/mm²	10
Flexural Modulus 25	kgf/mm²	8000
Coefficient of Thermal Expansion 1	ppm/	25
Coefficient of Thermal Expansion 2	ppm/	95
Glass Transition Temp.		140
Volume Resistivity at 25	cm	2 10¹⁶
Dielectric Constant at 1kHz		3.5
Recommended Cure Condition		100 /0.5Hr 150 /2Hr
Dispense Condition Device Temp.		22 50
Storage Condition		Below 5

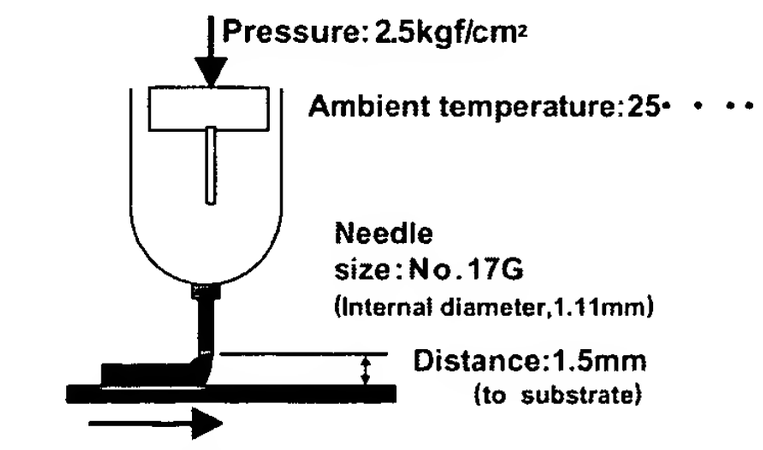
Measurement Method

2 0.1 g sample dropped



Aspect Ratio = Height / Width

3

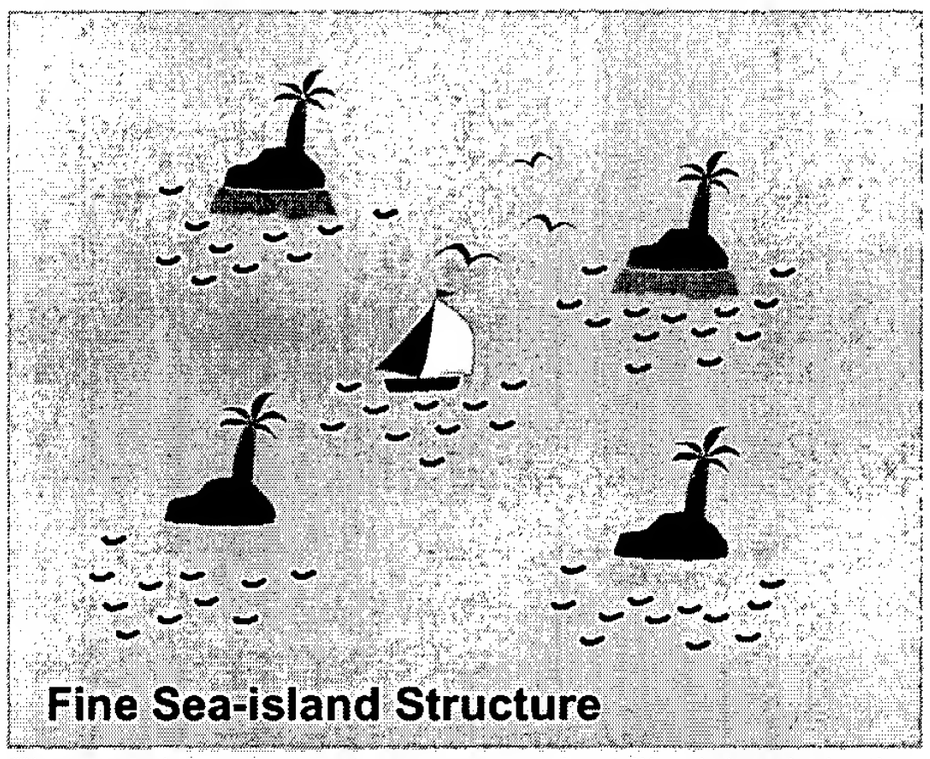


Aspect Ratio = Height / Width

SEMICOAT Series

Distinction of SEMICOAT• • •Low Stress Performance

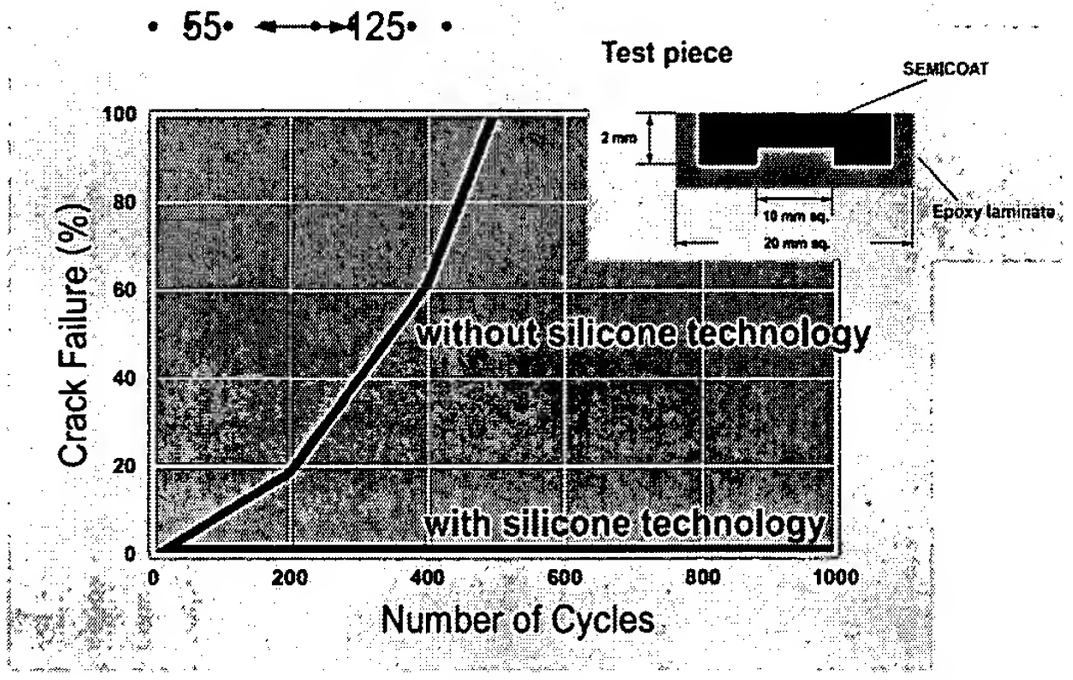
Security as great as the number of islands in the sea • • ••
This is the Shin-Etsu fine sea-island structure



Fine sea-island structure means, just like islands in the sea, silicone is dispersed equally in epoxy resin.
If there is distortion, that silicone islands will absorb it.

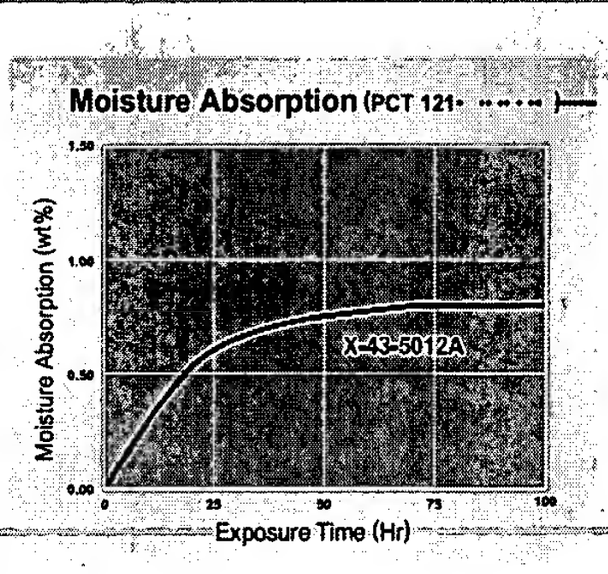
Heat Cycle/Condition B

• 55• ←→125• •

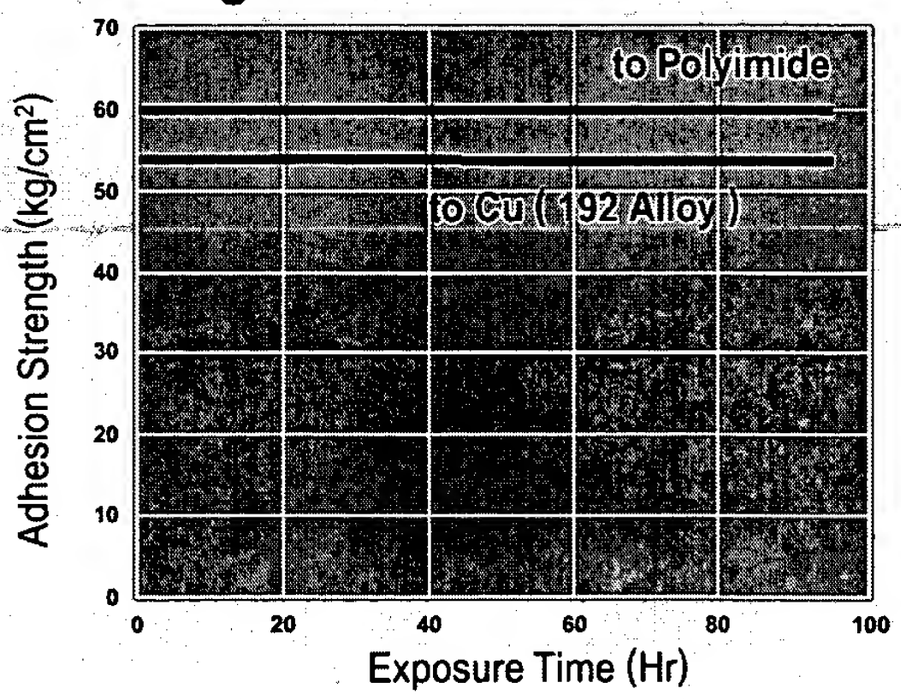


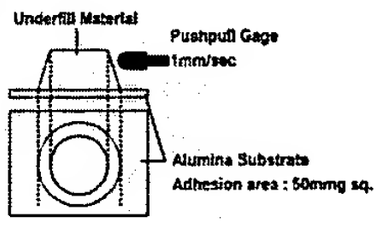
Potting

X-43-5012A Excellent Adhesion Property (Less Sensitivity to Moisture)



To Polyimide and Cu during PCT(121• /2.0atm)

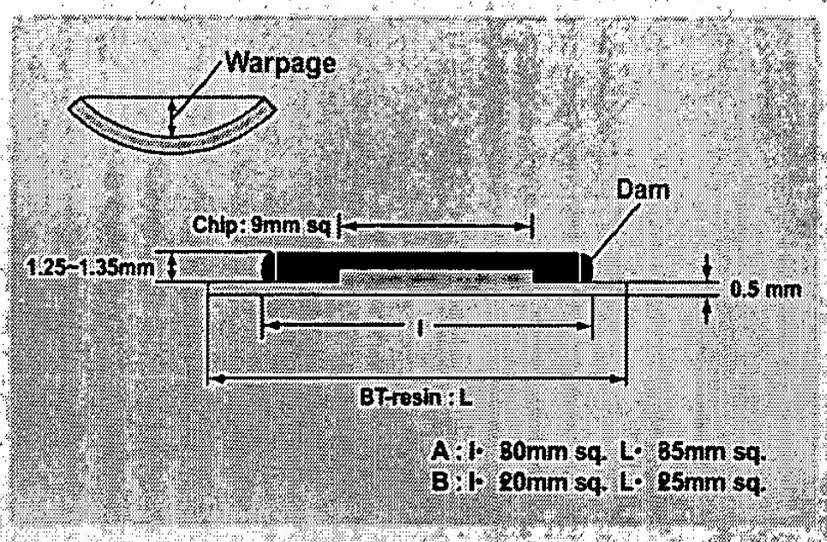




SEMICOAT 122

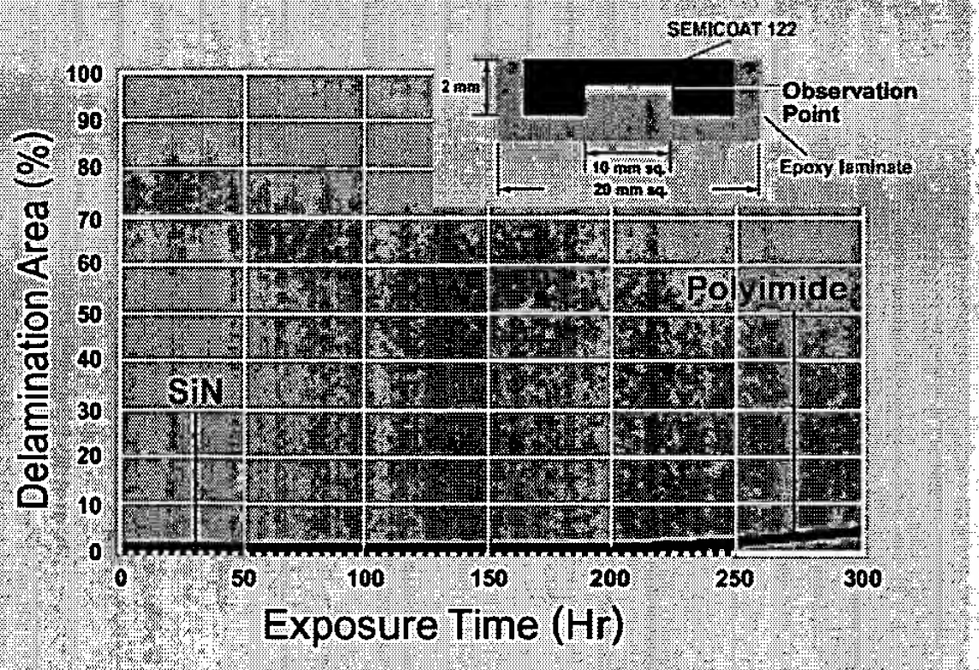
Small Warpage

Test Device	Cure Condition	Warpage • m•
A	100• /1Hr• 150• /2Hr	150
A	90• /3Hr• 150• /2Hr	60
B	90• /3Hr• 150• /2Hr	30



Good Adhesion to Organic and Inorganic Layer

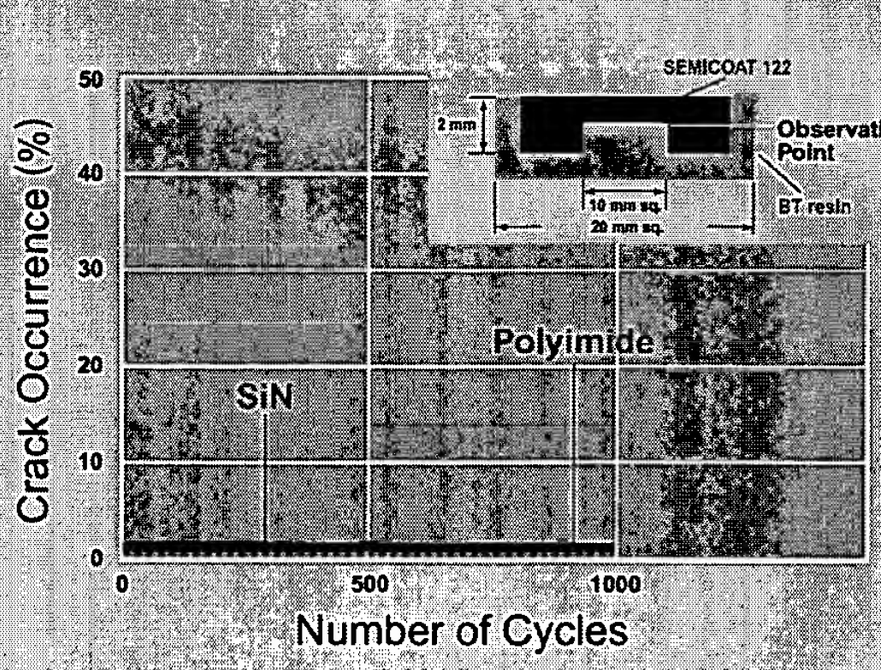
Delamination during PCT(121• /2.0atm)



Excellent Crack Resistane

Crack Failure during Temperature Cycle

• 55• (0.5Hr) • 125• (0.5Hr)



Popcorn Resistance

Pass JEDEC Level 3 test.

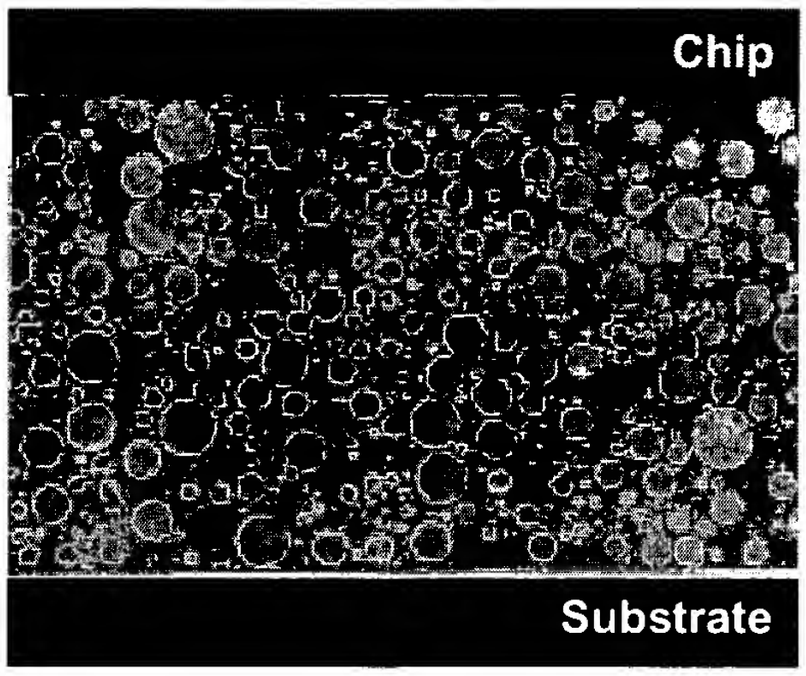
with 35mm sq. BGA device

1. Encapsulated devices are exposed to 30• /60• RH for 192Hr.
2. Devices undergo IR reflow Max 240• •.•
3. Crack occurrence is checked at the interfacial layer between Polyimide and SEMICOAT.

SEMICOAT Series

Underfill

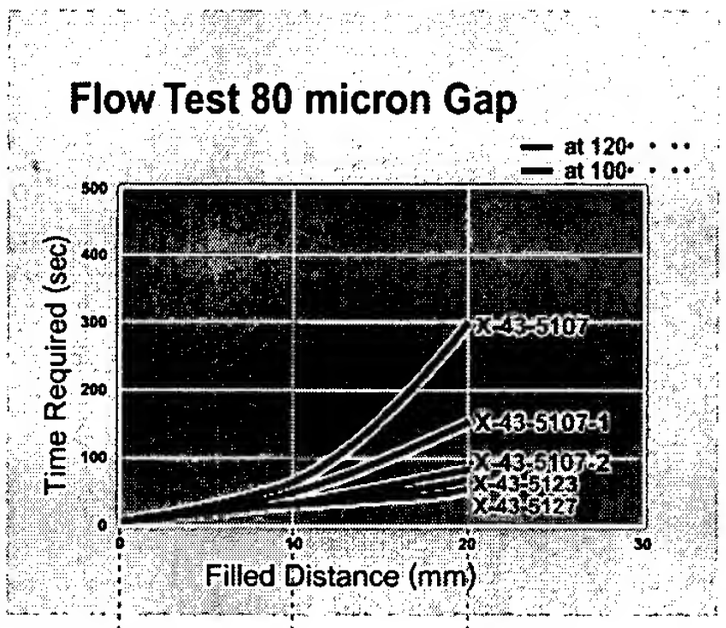
No Filler Settling



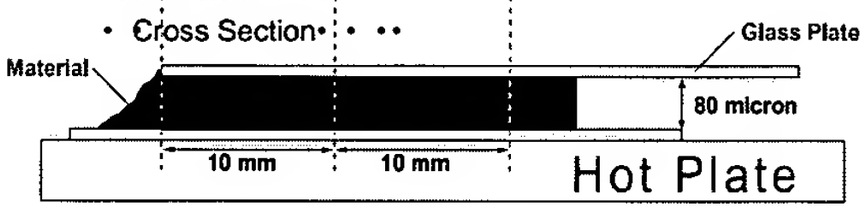
5107 cure condition• 120• /0.5Hr• 150• /2Hr• •

5123 cure condition• 100• /0.5Hr• 150• /2Hr• •

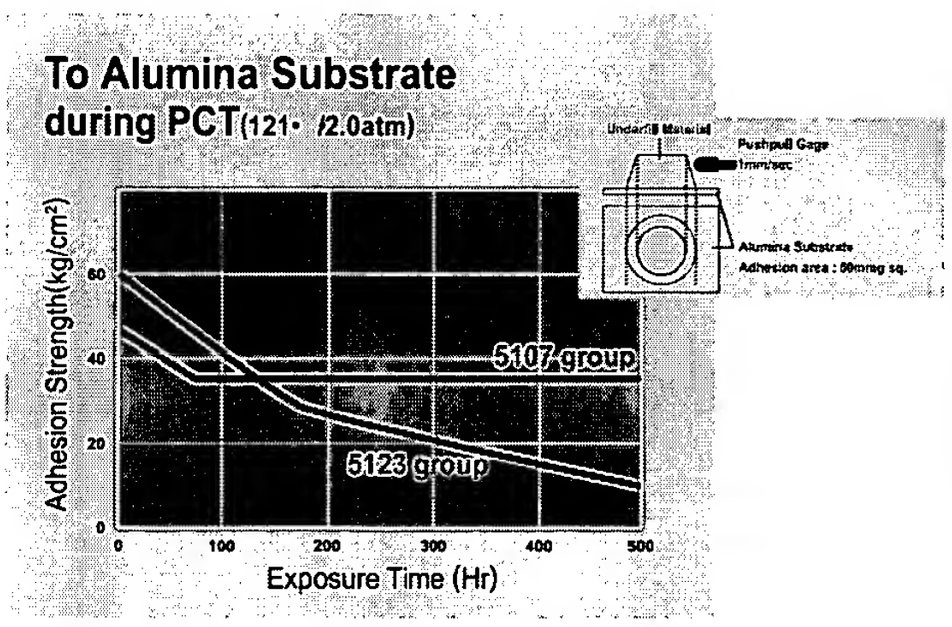
Penetration Speed

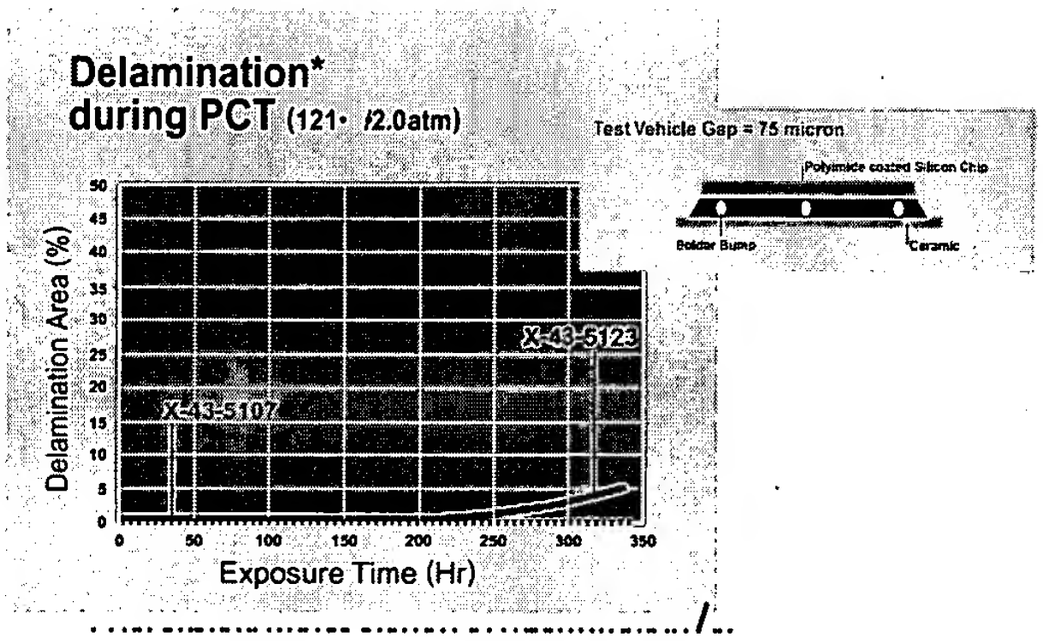


Test Method



Excellent Adhesion Property (Less Sensitivity to Moisture)





Dam Forming

Make a Shape Control Easy

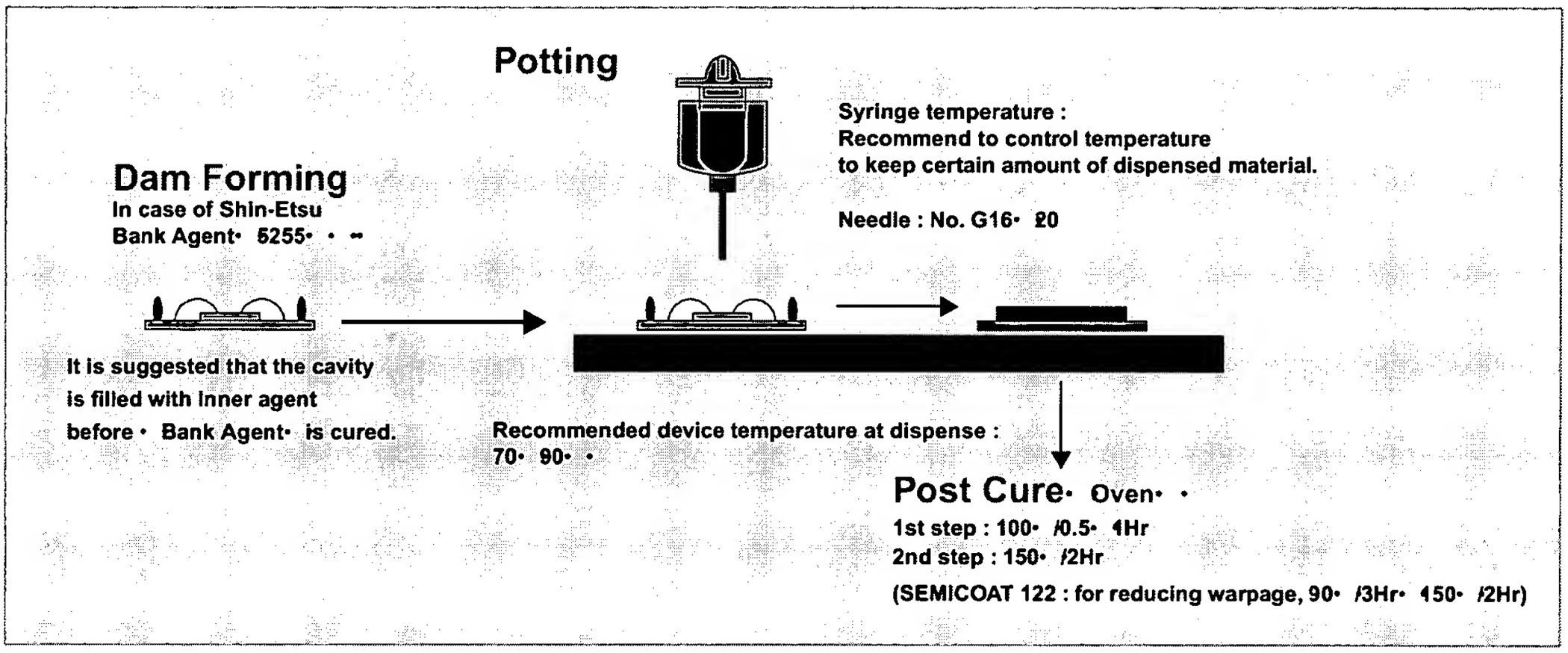
• Eliminated Cure Process for Dam Forming• •

Both dam forming agent and potting material can be cured at the same time. The cure process for dam forming agent is no need, because of its less shape change that might happen between dispense and post cure.

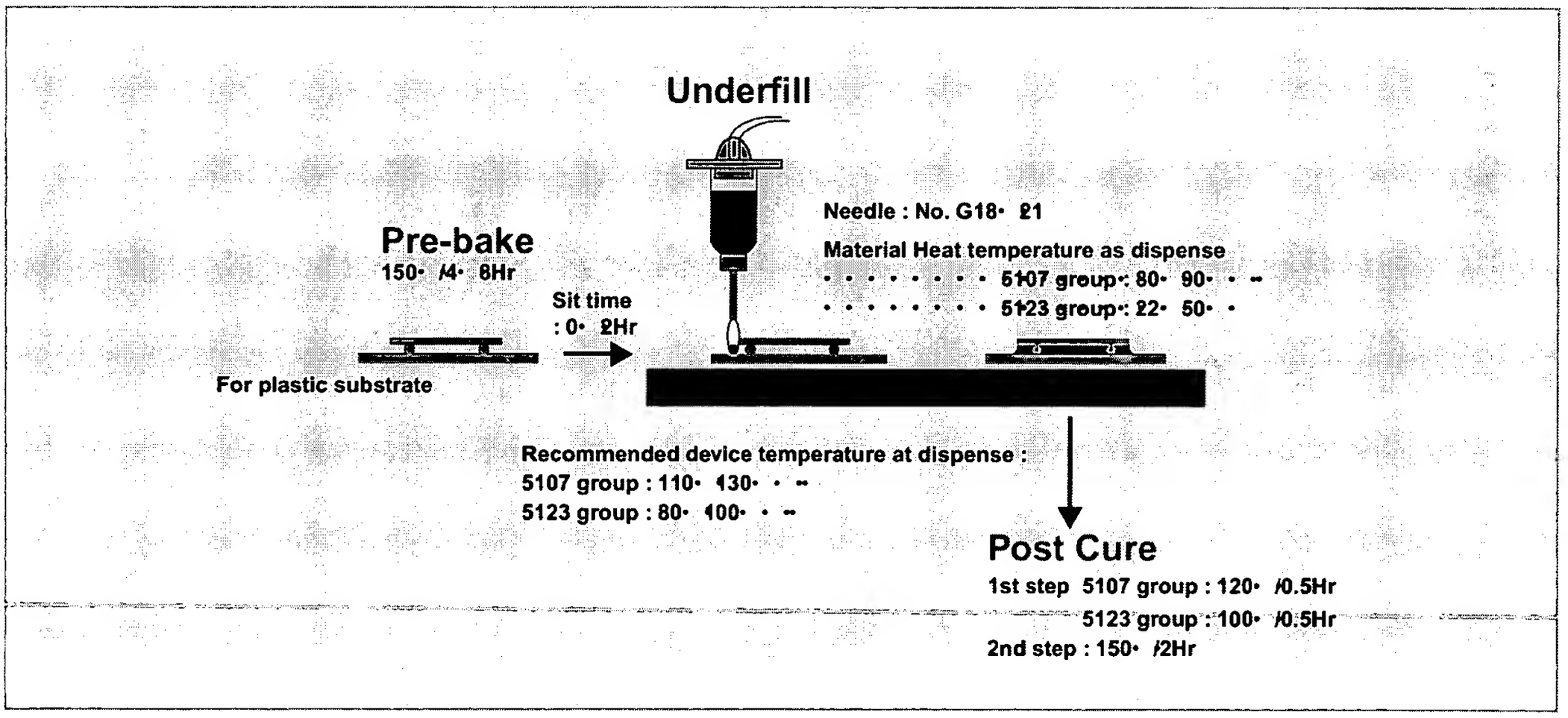
Ex.

Dam Forming • 5255 dispense• •
• •
Potting • 4115 dispense• •
• •
Cure

How to Use Potting and Dam Forming Agent



How to Use Underfill



Handling

Prior to using the product, remove it from cold storage and return it to ambient temperature.

Keep the product and assembled device dry for optimum performance. Moisture contamination may cause voids and degrade other important characteristics.

For safe handling, avoid skin contact and breathing vapor or dust during the use of this product. It is recommended to wear proper safety gears. If skin contact occurs, wash thoroughly with soap and water.

For details, please refer to MSDS.

Shin-Etsu Chemical Co.,Ltd.

Headquarters, Electronics Materials Division, Organic Electronics Materials Dept.

2-6-1 Otemachi, Chiyoda-ku, Tokyo 100-0004 Japan
. . . . . Phone 81-3-3246-5231. Facsimile 81-3-3246-5367

Shin-Etsu Electronics Materials Singapore Pte. Ltd.
100 Beach Road • 42-11 Shaw Towers Singapore 189702
. . . . . Phone 65-297-9211 Facsimile 65-297-9311. . . . . .

Gunma Complex
ISO 9001
ISO 14001

- Prior to use, please conduct tests to check if the products meet your requirements.
- We do not guarantee that applications introduced here do not infringe patents.
- The data of products shown in this catalogue may change without notice due to improvements.
- The data indicated in this catalogue are typical, not guaranteed.
- Due to laws, rules and/or regulations promulgated and administrated by the government of the exporting and/or importing countries, transactions of some of the products in this catalogue are subject to the authorization of the government of the exporting and/or importing countries. For details, please contact our sales representatives.

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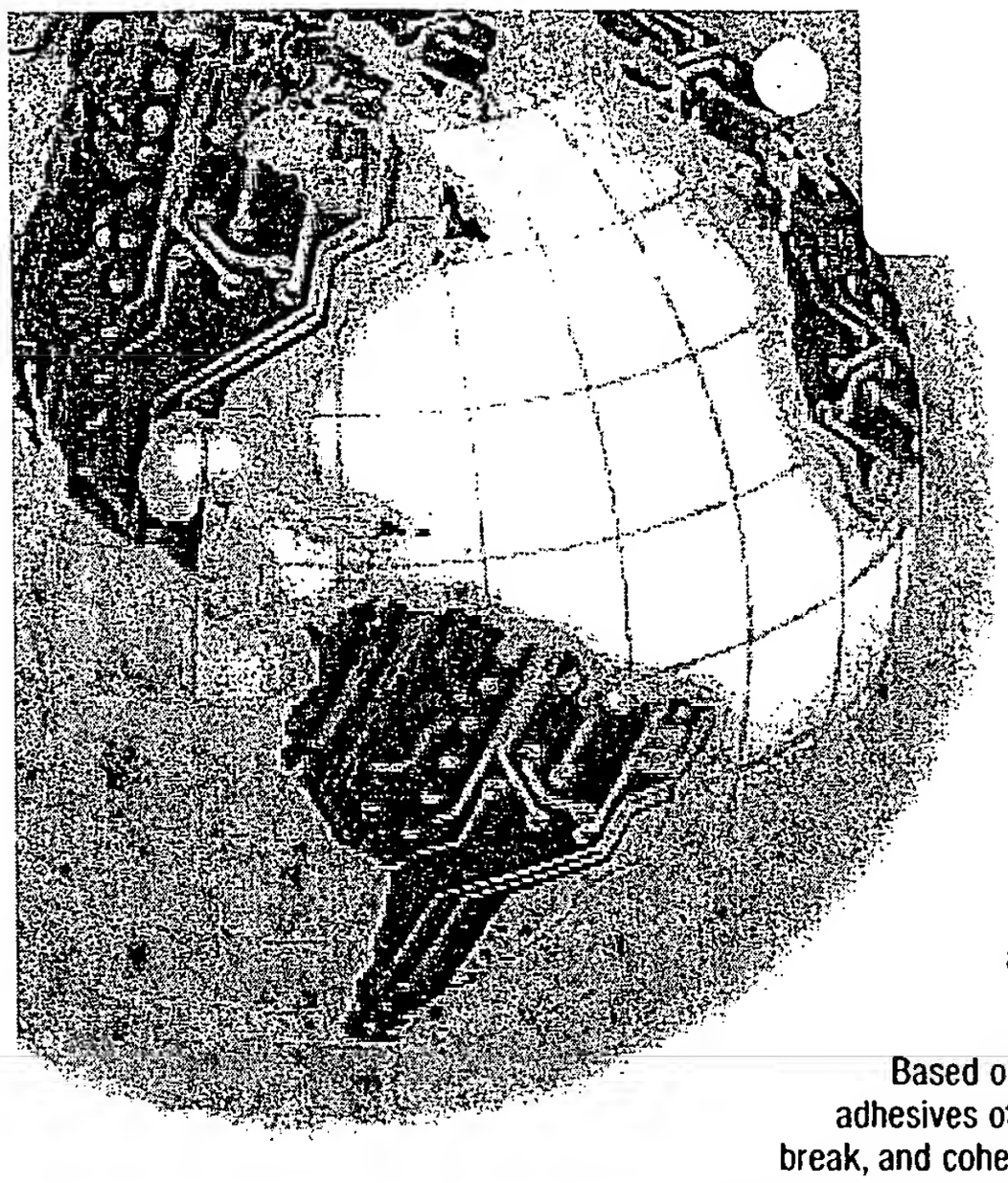


Hysol® Die Attach Adhesives

Elevated lead-free processing temperatures demand electronic packaging materials that can withstand polymer decomposition during reflow, increased interfacial stresses, and loss of adhesive and cohesive strength.

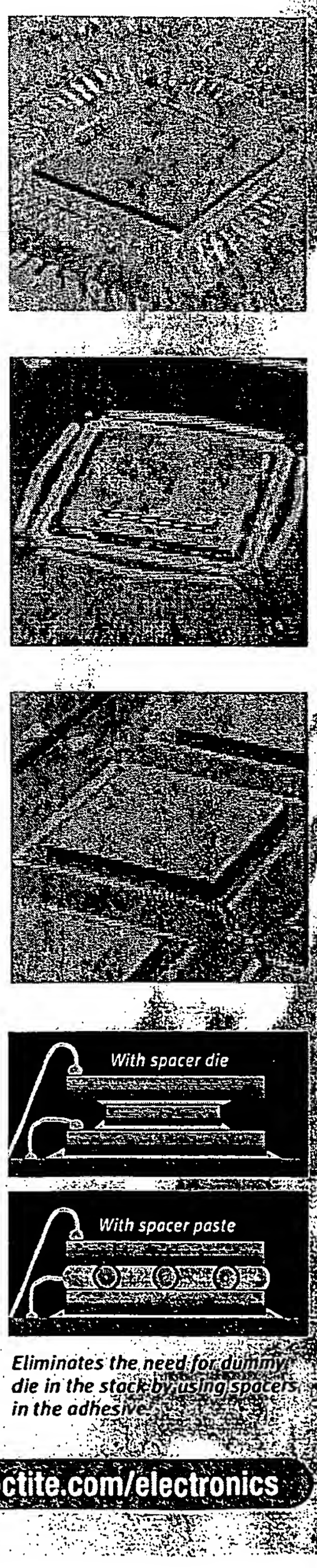
Based on ultra-hydrophobic chemistry, Hysol® die attach adhesives offer very high adhesive strength, elongation at break, and cohesive energy at high reflow temperatures. These properties help electronic packages retain adhesive strength and structural integrity during moisture soak and absorb stresses during the deformations associated with lead free reflow processing.

Designed to deliver superior quality and reliability, Hysol® die attach adhesives have won a number of supplier quality awards. Several products are formulated with PTFE, an extremely low dielectric constant material that will not abrade polyimide and other die passivation.

Our fast reaction kinetics and solvent-free formulation enables inline SkipCure™ processing that increases UPH for adhesive cure, eliminates the need for separate curing equipment, and decreases package warpage. Our adhesives for organic substrates eliminate substrate prebaking, while our patented polymeric spacers deliver consistent bondline thickness, reduce tilt, and enable high UPHs for die placement.

With our products, our customers can use conventional oven cure as well as snap cure, and when they are ready, they can also Skipcure and SkipPrebake[1]. Our organic products can also be converted to their CCSP™ (controlled collapse spacer paste) versions without changing the base paste properties. The ability to exercise these three options, Skipcure, SkiPrebake[1], and Spacers at zero or minimal switching costs allow lower cost of use and lower cost of ownership for our customers equipment.

[1] *For products designed for organic laminates*



Eliminates the need for dummy die in the stack by using spacers in the adhesive

www.loctite.com/electronics

Hysol® Die Attach Adhesives for Non-Hermetic Packages

For organic substrates including laminates, array, BGA and CSP packages

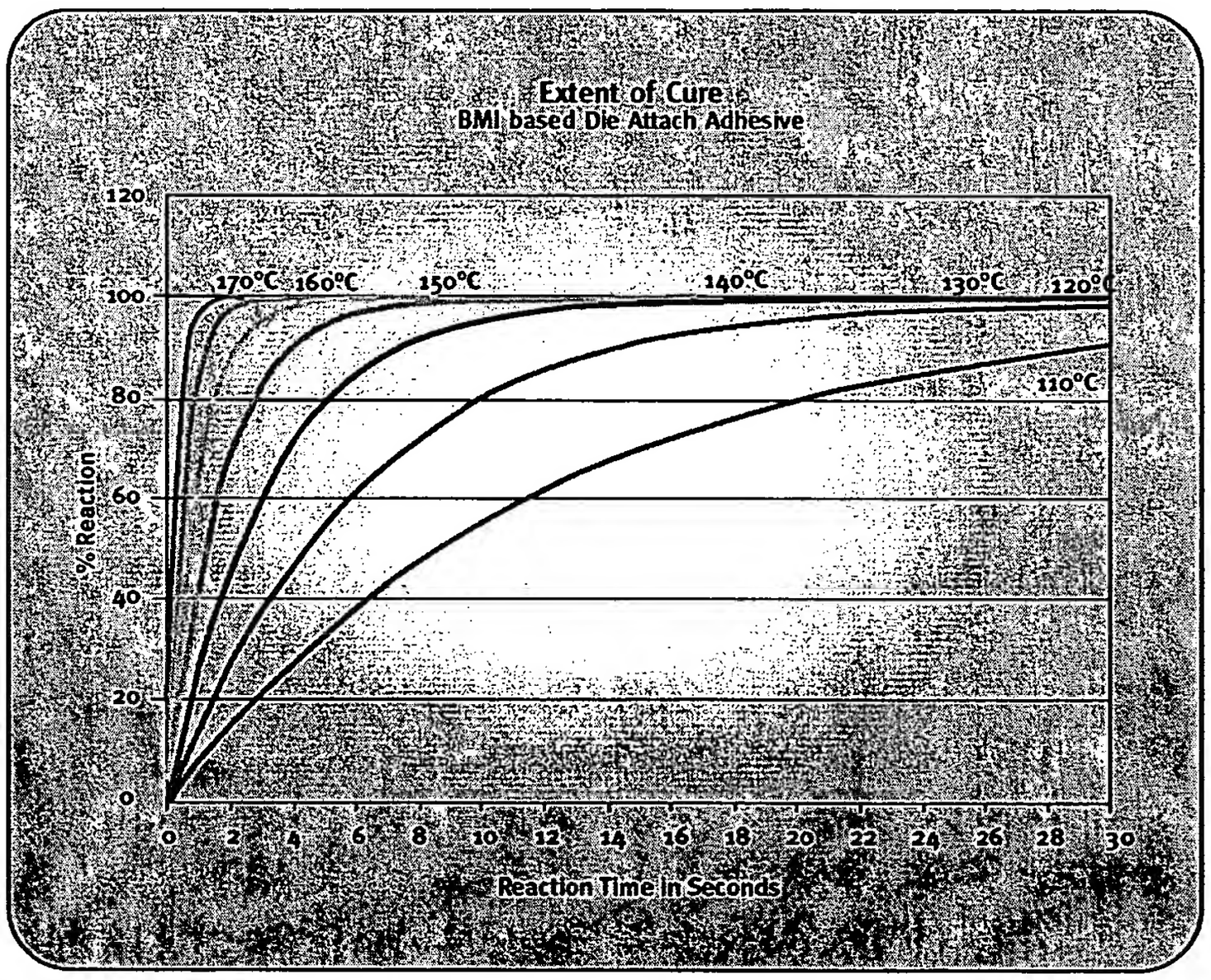
Materials	Description/Application	Resin	Filler	Oven Cure /SkipCure®	Viscosity 5rpm@ 25°C	Thermal Conductivity	Tg* (°C)	CTE α_1/α_2	Modulus @ 25°C	Storage Temp.
QMI 550	**Stacked Die In CSP, BGA** Dielectric, very high adhesive and cohesive strength and elongation at Pb-free reflow temperatures	BMI	PTFE	15 min. @ 150°C Oven 10 secs. @ 150°C SC	11500 cps	0.2 W/m°K	-10	91 150	1.0 GPa	-40°C
QMI 536	**Industry Standard** De facto industry standard for die-to-die bonding; dielectric, high adhesive strength material for organic substrates	BMI	PTFE	15 min. @ 150°C Oven 10 secs. @ 150°C SC	9000 cps	0.3 W/m°K	-31	93 174	0.30 GPa	-40°C
QMI 536HT	**High Thermal Version of QMI 536** Dielectric, high thermal conductivity adhesive for organic laminates, and die-to-die bonding; ideal for mixed stacked die applications	BMI	Boron Nitride	15 min. @ 150°C Oven 10 secs. @ 150°C SC	13000 cps	0.9 W/m°K	4	66 177	0.85 GPa	-40°C
NEW QMI 550SI	**Low CTE Version of QMI 550** Silica-filled for low shrinkage and low warpage on laminate and flex substrates	BMI	Silica	15 min. @ 150°C Oven 10 secs. @ 150°C SC	17000 cps	0.6 W/m°K	33	43 91	1.50 GPa	-40°C
NEW QMI 550EC	**Electrically Conductive** Silver-filled version of QMI 550; very high adhesive and cohesive strength	BMI	Silver	15 min. @ 150°C Oven 10 secs. @ 150°C SC	17000 cps	3.8 W/m°K	2	56 148	2.8 GPa	-40°C

For inorganic substrates including Cu, Pd, Ag & Au plating, ceramic, and black oxide

Materials	Description/Application	Resin	Filler	Recommended Cure	Viscosity 5rpm@ 25°C	Thermal Conductivity	Tg* (°C)	CTE α_1/α_2	Modulus @ 25°C	Storage Temp.
QMI 519	**JEDEC L1 260C for SOIC, QFN** De factor industry standard for QFN packages. Good for all preplated leadframes, and bare copper. Higher adhesion, excellent electrical and thermal performance.	BMI	Silver	15 min. @ 185°C Oven 10 secs. @ 200°C SC	9000 cps	3.8 W/m°K	75	40 140	5.3 GPa	-40°C
NEW QMI 519HT02	**High Thermal Conductivity** Very high electrical and thermal conductivity while maintaining excellent adhesion. Suitable for high heat dissipating devices.	BMI	Silver	15 min. @ 185°C Oven 10 secs. @ 200°C SC	18800 cps	7.3 W/m°K	49	42 104	6.70 GPa	-40°C
QMI 505MT	**For Pd, Alloy 42, Au and Black Oxide** Similar to QMI 519 but with superior adhesion to palladium, alloy 42, gold and black oxide finishes.	BMI	Silver	15 min. @ 185°C Oven 10 secs. @ 200°C SC	12100 cps	2.0 W/m°K	10	72 170	0.86 GPa	-40°C
QMI 518	**Electrically Conductive, Large Die** Similar properties to QMI 519, but formulated to have a low modulus to reduce stress on die larger than 500 x 500 mil./13x13 µm	BMI	Silver	15 min. @ 180°C Oven 10 secs. @ 200°C SC	8500 cps	1.4 W/m°K	-64	69 152	0.10 GPa	-40°C
QMI 534	**Non-Conductive, Small Die** Non-conductive, very high adhesive strength on metal substrates for die sizes less than 500 x 500 mil./13x13 µm	BMI	PTFE	15 min. @ 175°C Oven 10 secs. @ 200°C SC	9000 cps	0.4 W/m°K	35	87 171	0.30 GPa	-40°C
QMI 538	**Non-Conductive, Large Die** Non-conductive, very high adhesive strength on metal substrates for die sizes greater than 500 x 500 mil./13x13 µm	BMI	PTFE	15 min. @ 175°C Oven 10 secs. @ 200°C SC	8500 cps	0.3 W/m°K	-70	85 149	0.10 GPa	-40°C
QMI 536UV	**UV Cure - CCD/CMOS Glass Lid Sealing** Non-conductive, UV curing resin with excellent adhesion to glass. Ideal for glass lid-sealing CCD or CMOS lenses.	BMI	PTFE	1 min. @ 100mW/cm2	6700 cps	0.3 W/m°K	26	62 136	0.7 GPa	-40°C
QMI 282HT	**Non-conductive, Ultra Low Stress** Very low modulus silicone with good thermal properties for low stress, high temperature applications.	Silicone	Alumina & Zinc Oxide	30 min. @ 150°C or 1hr. @ 120°C (No SkipCure)	49400 cps	1.0 W/m°K	-40	N/A 104	0.004 GPa	5°C+/-3°C
K00125	**General Purpose Silver Epoxy** Silver-filled epoxy for general bonding purposes that require electrical and thermal conductivity.	Epoxy	Silver	10 min. @ 165°C (No SkipCure)	9200 cps	2.1 W/m°K	96	65 130	4.0 GPa	-40°C

Hysol® Die Attach Adhesives for Hermetic Packages

Materials	Description/Application	Resin	Filler	Recommended Cure	Viscosity 5rpm@ 25°C	Thermal Conductivity	Tg* (°C)	CTE α_1/α_2	Modulus @ 25°C	Storage Temp.
QMI 301	**Solder and seamed sealed packages.** Low temperature cure material with very high adhesion and >340°C temperature resistance for solder-sealed hermetic packages.	Cyanate Ester	Silver	10 min. @ 150°C	11400 cps	1.9 W/m°K	245	45 85	6.9 GPa	-40°C
QMI 2419	**No-dry Ag glass die attach for glass-sealed packages.** Very high thermal conductivity and >450°C temperature resistance.	Glass/Solvent	Silver	See ramp profile 7-10 min @ 420-460°C	37500 cps	>60 W/m°K	300	21 N/A	15.1 GPa	RT on Rollers
QMI 2569	**No-dry Ag glass die attach for glass, solder, and seamed sealed-packages.** Very high thermal conductivity and applications for die as large as 0.800 square.	Glass/Solvent	Silver	See ramp profile 7-10 min @ 360-440°C	35800 cps	>60 W/m°K	250	16 N/A	15.1 GPa	RT on Rollers
QMI 3555R	**No-dry Ag glass die attach for glass, solder, and seamed sealed-packages.** Very high thermal conductivity and >450°C temperature resistance for glass-sealed hermetic packages.	Glass/Solvent	Silver	See Ramp Profile 7-10 min@ 300-450°C	40000 cps	>80 W/m°K	150	16 N/A	11.5 GPa	RT on Rollers



All Hysol® QMI 500 series die attach adhesives use free radical cure, enabling extremely fast cure rates (Fig.1). Adhesives in this series cure in seconds at the appropriate temperature, instead of minutes or hours. This feature allows the adhesives to be cured in-line right on the diebonder, immediately after the substrate is indexed onto the post-bond cure station or on the wirebonder preheater. This enables high UPH which translates to low total cost-of-use. SkipCure also improves the quality of the cured part. Because the substrate is held down flat during die attach cure, the resulting substrate warpage is much lower than on oven-cured substrates. Furthermore, the short distance between bondsite and post-bond cure station minimizes adhesive slump and die movement before cure, allowing more consistent bondline thickness.